Big Game or Small Plants? Assessing The Role of Plants in the Neanderthal Diet via Microscopic Residue Analysis of Flint Tools

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Abstract

Neanderthals inhabited Europe and western Asia from approximately 300,000 to 30,000 years ago. They are often characterized as brutish big-game hunters who were "less intelligent" than early modern humans, and thus lost to our ancestors in the race for survival. Stable isotope and zooarchaeological analyses suggest that Neanderthal diet consisted predominately of big-game meat (e.g. woolly mammoth). They would not have survived for over 200,000 years eating meat alone. A diet high in lean meat can induce "protein poisoning" caused by excess nitrogen and can lead to malnutrition and death. To avoid this scenario, Neanderthals likely ate "smaller game" animals like rabbits and fish, as well as the abundance of plant resources available to them. The goal of this research was to investigate the role plants played in the Neanderthal diet by creating a comparative database of plant residues which can be used to identify archaeological plant fragments. Local edible wild plants that also occur in Europe were collected and processed with stone tools and then examined microscopically. These results were then compared to residues from the Neanderthal site of Maras, France (figure 2) and suggest that Neanderthals were processing plants such as wild parsnip and burr-reed.

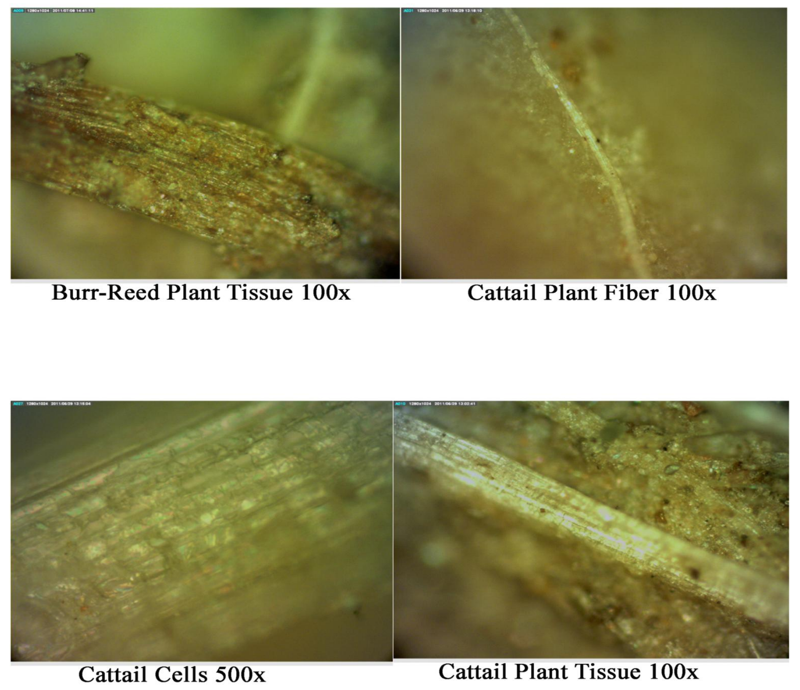

Figure 1. Bur-Reed and Cattail plant tissue.

Introduction

Lean meat can be consumed to account for most of the necessary micronutrients needed for survival, however severe physiological problems can occur if more than 35% of the total dietary energy is derived from it, a condition which is referred to as "protein poisoning." Since Neanderthals were thought to have consumed 3000-4000 kCal diets, the question is what accounts for the remaining 65% of dietary energy (Hardy 2009)?

Dietary reconstuctions through stable isotope analysis suggests "that Neanderthals were possibly as carnivorous as large predators…. [Their] source of protein was most likely the meat of terrestrial ungulates, without excluding a complement of plant food in the diet" (Bocherens, 2009: 245). However, there are those who believe that "the earliest humans relied heavily, although possibly not exclusively, on plant resources" (Madela et. al., 2002: 703). However, plant remains in the archaeological record are notoriously difficult to come by. Speth points out that "big-game is likely to be overrepresented in our samples of the archaeological record… after all, bones, especially big ones, ought to preserve well, certainly much better than the perishable remains of plant foods" (Speth, 2010:27).

Plants can also account for a number of key vitamins and other nutrients not found in lean meat (Table 1). In addition, energy value of some of the larger underground storage organs can almost rival that of lean meat resources.

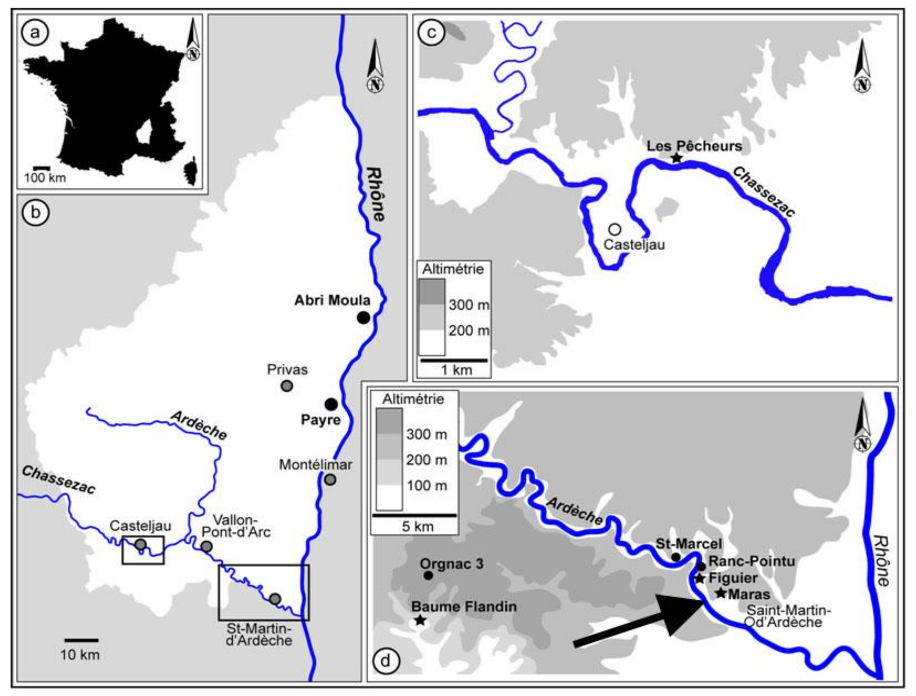

Figure 2. Neanderthal site in Maras, France (modified after Moncel, 2010).

Scientific Name	Common Name	Energy (kcal)	Protein (g)	Fat (g)	Carb. (g)	Fiber (g)	Ca (mg)	Vit. C (mg)	Vit. A (IU)	Source
Pastinaca sativa	wild parsnip	76	1.7	0.5	17.5	2	50	16	3	Kuhnlein
Arctium lappa	greater burdock	94	3.1	0.1	17	-	50	72	310	USDA
Arctium lappa	greater burdock	72	1.5	0.2	33.4	1.9	41	3	-	USDA
Sparganium erectum	burr-reed	-	1.1	-	-	-	46	-	-	USDA
Sagittaria latifolia	arrowhead	25	1.3	0.1	5.1	-	2.5	0.3	0	Nutritiondata.com
Typha latifolia	cattail	25	1.18	0	5.14	-	-	0.7	1	USDA
Rangifer tarandus	caribou	127	22.6	1.8	0	0	17	0	0	Hardy 2009

Table 1. Select nutritional data for plants and sources of lean meat.

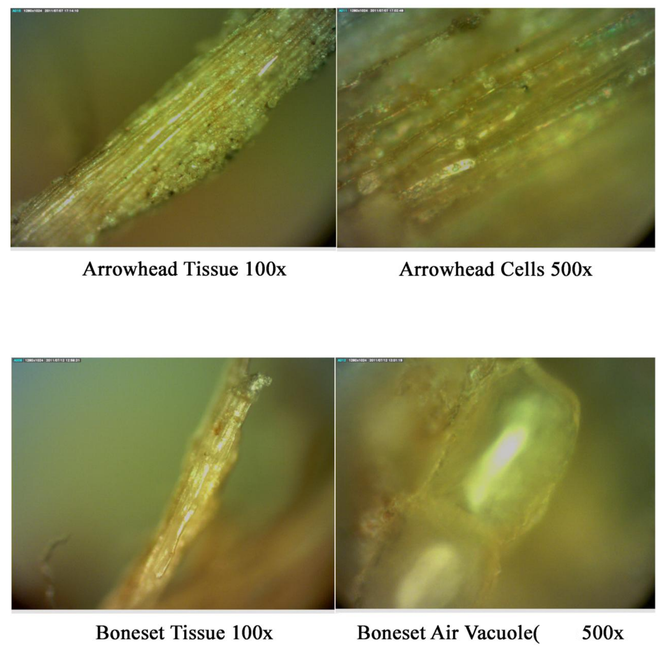

Figure 3. Arrowhead & Boneset plant tissue

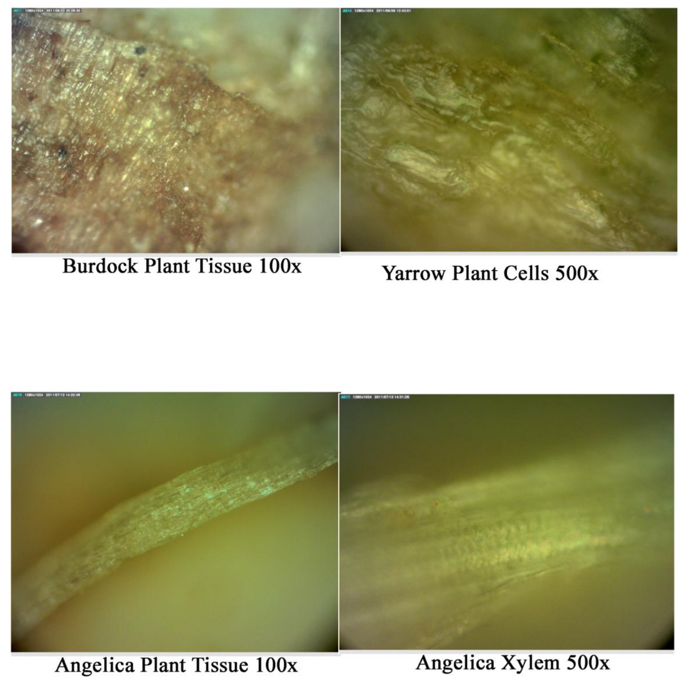

Figure 4. Burdock, Yarrow, & Angelica plant tissue.

Methods

My research began by creating a database of edible plants that could be found in both Gambier, Ohio and continental Europe (PFAF, 2011). Using a sharpened wooden digging stick, I excavated specimens of 12 candidate species with edible underground storage organ (USOs). All 12 of the plant species were processed with flint tools to remove external cortex and make them more palatable (cutting, scraping, chopping, or mashing the root).

Unwashed, minimally handled flint tools were examined with Olympus BX30 reflected light microscope (50-500x). All adhering residues were photographed with a DinoLite Dinoeyepiece Digital USB Camera and DinoCapture 2.0 Software. These phtographs were compared with published material for identification of specific tissues (cortex, epidermis, xylem, starch grains, etc.; Hather, 1993). Finally I examined photographs of residues found at the Maras Neanderthal site in France, and compared them to the photographs of the 12 plant species I analyzed here in Ohio in an attempt to find a morphological match (Figures 1, 3-6).

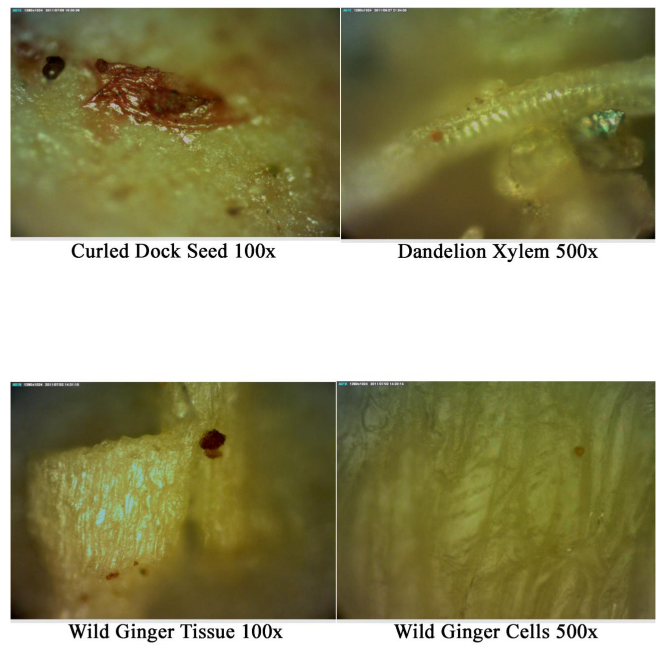

Figure 5. Curled Dock, Dandelion, & Wild Ginger plant tissue.

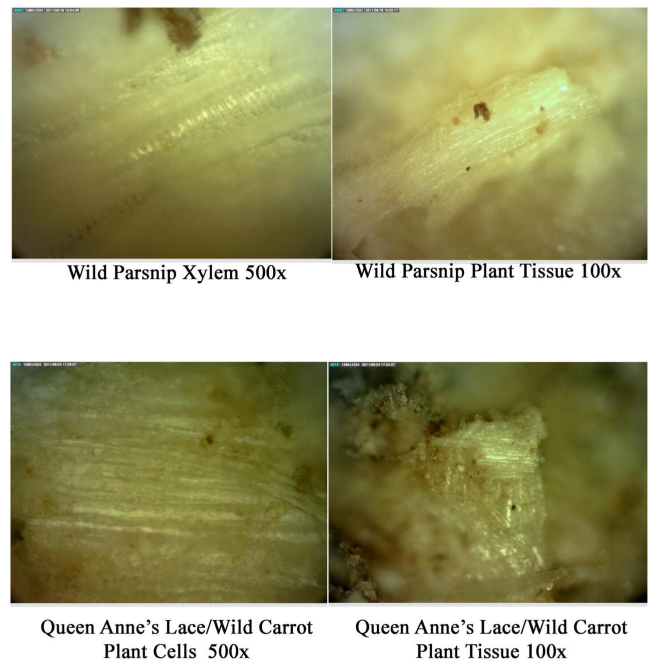

Figure 6. Wild Parsnip & Queen Anne's Lace/Wild Carrot plant tissue.

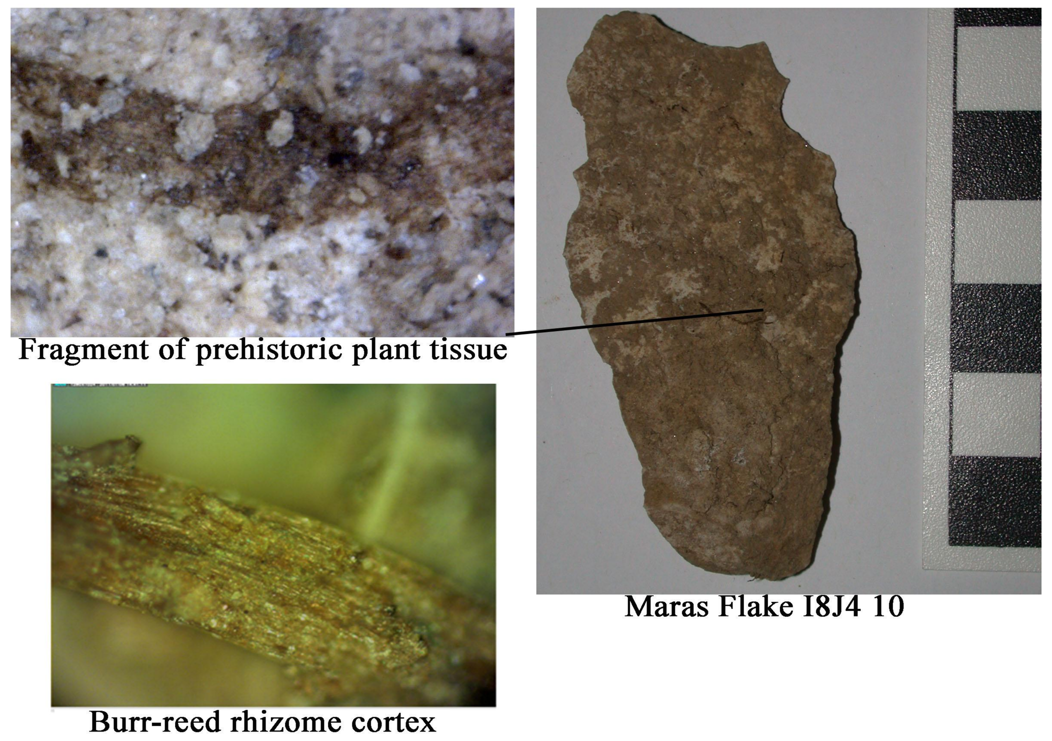

Figure 7. Comparative image of Maras flake & bur-reed rhizome cortex.

Results

The site of Maras is a rockshelter located in the Ardeche Valley in southern France (Figure 2). The site was occupied from approximately 95,000-75,000 years ago. A sample of 101artifacts have been examined microscopically for the presence of use-related residues (Hardy pers. Comm. 2011). An analysis of the photographs of these residues revealed two cases where the morphology of the residue matched the morphology of residues from experimental processing of USOs (Figure 7 & 8).

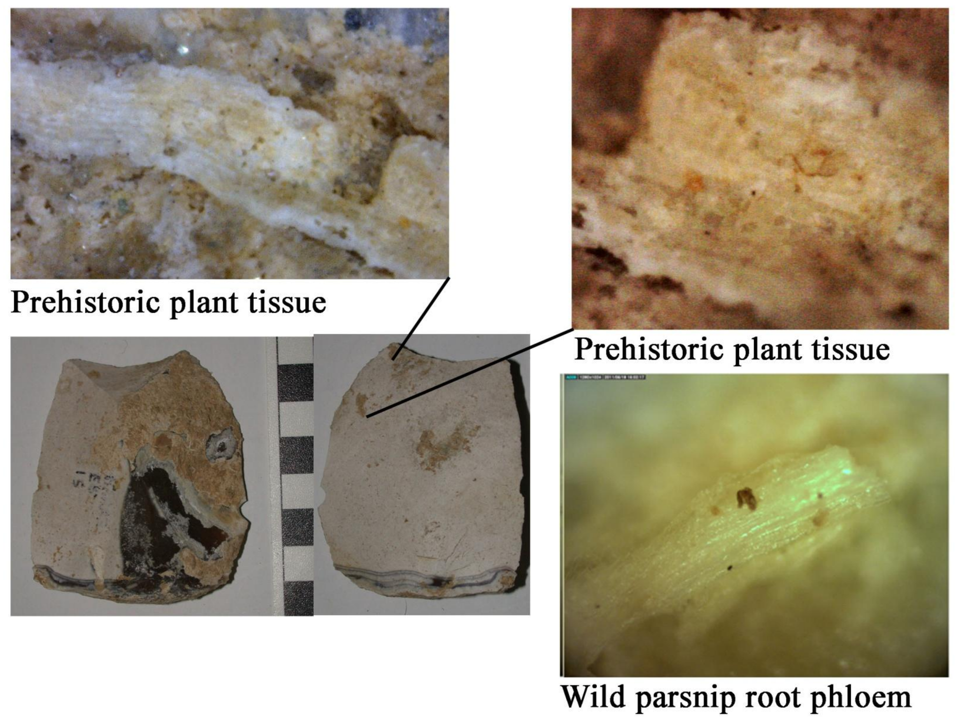

Figure 8. Comparative image of Maras flake and wild parsnip root phloem.

Acknowledgements

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Discussion & Conclusion

The goal of this project was primarily to build up a database of pictures, whose content could be identified as characteristic of that plant or plant species. In addition, we have found two possible matches **(**Figure 7 & 8) between *Pastinaca sativa* (wild parsnip) and *Typhaceae sparganium* **(**Bur-reed) residues found on our replica tools and tools found at a Neanderthal site in Maras, France. While we cannot conclude that it is a definitive match, there are certainly similarities between the cell types, size and shape. Both of these plants can occur in relatively cold climates (Hardy, 2010) and would have potentially been available to the inhabitants of the site. Nutritional data suggest that wild parsnip could have provided an important energy source as well as calcium and vitamin C, two micronutrients that are lacking in a high meat diet.

This research suggests that the Neanderthal diet may have been more varied than some researchers claim. Further work expanding the wild edible plant microscopic database may allow for more specific identifications of plants in the future.

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